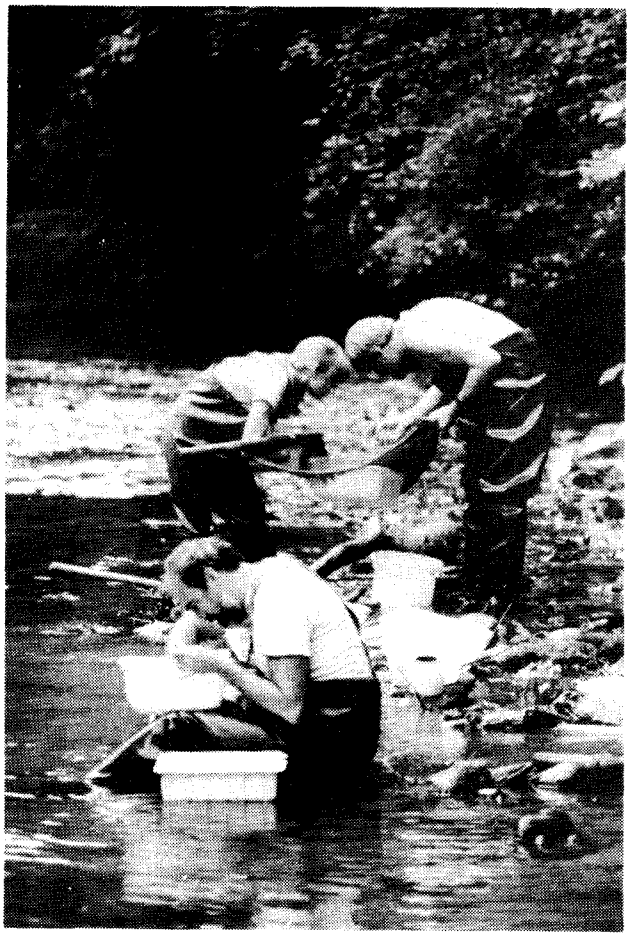

REPORT OF THE NATIONAL WORKSHOP ON INSTREAM BIOLOGICAL MONITORING AND CRITERIA

REPORT OF

THE NATIONAL WORKSHOP

ON

INSTREAM BIOLOGICAL MONITORING AND CRITERIA

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Essential contributions came from the States' Representatives and academic researchers who spoke at the workshop, who are listed in Appendix B, and from all participants in the workgroups through their discussions at the workshop and their review of this document. Susan Davies, James Giattina, John Giese and Chris Yoder served as official reviewers. Thom Whittier assembled and edited this report.

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TERMINOLOGY

This section "defines" some of the terms used at the Workshop. These are working definitions only, and somewhat general; they are presented for purposes of clarification and continuity in this report. It is apparent from discussions at the workshop and from comments to earlier drafts of this document, that many of these terms are used inconsistently or are misunderstood. The U.S. EPA should provide clear definitions for these terms and foster consistent usage.

Standards -- the legally established State rules consisting of two parts, designated uses and criteria.

Designated Uses -- the purposes or benefits to be derived from a waterbody, e.g., drinking water, aquatic life.

Criteria -- the conditions presumed to support or protect the designated use(s), e.g., dissolved oxygen not less than 5 mg/l to protect a cold-water fishery use designation.

Biocriteria -- the numerical or narrative expressions of the biological characteristics of ambient aquatic communities (often structural measures, e.g., species composition, organism abundance and diversity). Biocriteria, as generally applied in State programs, are designed to reflect attainable characteristics under minimally impacted conditions. As such, biocriteria describe the ecological potential for aquatic community health in a given watershed, drainage basin or ecological region.

Ambient (Instream) Biological Sampling -- the process of collecting a representative portion of the organisms living in the waterbody of interest, to determine the characteristics of the lotic or lentic aquatic community. Fish and benthic macroinvertebrates are usually sampled. This term includes short- or long-term surveys and monitoring.

Biosurvey -- used synonymously with ambient biological sampling, in this report.

Biological Integrity -- a measure of the state of health in aquatic communities. A healthy aquatic community is a balanced community of organisms having a species composition, diversity and functional organization comparable to that found in natural (unimpaired) habitats in the region (Karr et al. 1986). Also called "Biotic Integrity".

Bioassay -- the procedure of exposing test organisms, in a laboratory setting, to various concentrations of suspected toxicants or dilutions of whole effluent.

Toxicity Test -- used synonymously with bioassay, in this report.

In Situ Bioassay -- is conducted on test organisms, in the ambient water or discharge mixing zones, for known exposure periods, e.g., with caged fish or clams.

Chemical-Specific Criteria -- criteria that set specific allowable concentrations of individual chemicals in the water. These criteria are presumed to be protective of the designated aquatic life uses, as well as other uses, e.g., drinking water or human health ("swimmable" conditions).

Whole Effluent Testing -- a bioassay using the complete discharge "as it comes from the pipe", as opposed to separate bioassays on the individual component chemicals.

Ecoregions -- broad scale areas with a common ecological characteristic, e.g., Central Corn Belt Plains, Western Allegheny Plateau, etc. Also called Ecological Regions.

Biosurveillance -- used synonymously with biosurvey in this report. Also can be used to describe a series of systematic biosurveys.

Bioassessment -- assessment of the condition of a waterbody using any available biological methods. Biosurvey and bioassay are common bioassessment methods.

Biomonitoring -- is conducted to ensure standards or effluent limitations are being met using either the ambient community or toxicity tests.

EXECUTIVE SUMMARY

The purpose of the National Workshop on Biocriteria was to assess the role of **biocriteria*** and information generated by **ambient biological sampling** in the State and Federal surface water programs. This workshop was convened, in part, in response to the Water Quality Act (WQA) of 1987, Section 303(c)(2)(B), which requires U.S. EPA to develop criteria based on biological assessment methods when numerical criteria are not established for the priority pollutants listed in Section 307(a) of the Clean Water Act (CWA); and in part to bring together a nationwide group of aquatic biologists and water resource managers who are presently developing and/or applying biocriteria to protect or restore the **biological integrity** of the Nation's waters.

This report summarizes the recommendations of the workshop and illustrates to regulatory agencies that biosurveys are an important monitoring and evaluation tool, and that biocriteria can provide, in a quantifiable regulatory context, a measure of the attainment of the interim goals of Section 101(a)(2) of the WQA.

The workshop participants represented 18 States, nine U.S. EPA Regional offices, three EPA laboratories and three headquarters Offices and Divisions, as well as other organizations and universities (TVA, U.S. Geological Survey, Environment Canada, etc.). This illustrates the interest in biological criteria and ambient biological sampling to protect the Nation's waters, and the need for guidance and support in developing these tools.

STATE APPROACHES TO BIOCRITERIA

In the past, the U.S. EPA and States have generally been discouraged by: perceived problems of variability, complexity, and cost of assessing ambient biological conditions; applying such information to water resource management; setting standards and assessing attainment of those standards; and formulating and implementing regulatory controls. However, several States have independently found that reliance solely on **chemical-specific** criteria and **toxicity tests** is insufficient for protecting aquatic life **designated uses** as mandated by the WQA. These States have therefore included biocriteria in developing a more integrated approach to the protection of aquatic life. At the Biocriteria Workshop, ten States presented their development and use of biocriteria and **biosurvey** methods. While no two States use exactly the same biocriteria and biosurvey procedures, several common themes were evident from their presentations:

- States in different regions of the country face different problems and conditions, but appropriate biocriteria have been established to successfully address many of these problems. There is considerable potential for applying similar ambient biological sampling methods among neighboring States that share similar ecological regions.

- Within each State, extensive knowledge concerning the biological conditions of the waterbodies exists among State regulatory personnel and academic researchers. These experiences, in combination with databases from biological surveys can provide the initial framework for establishing biocriteria and developing biosurveys (i.e., no State needs to start from a "no information" position).

- In the ten States presenting papers at the workshop, professional aquatic biologists have been active participants in the process of establishing biocriteria, performing biosurveys, analyzing data, and writing and reviewing reports.

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*Boldface terms "defined" in the Terminology Section p. iv.

- All ten States use systematic and standardized methods to collect and analyze ambient biological community based data (as opposed to indicator species). Measures of biological integrity range from a fairly simple diversity index of benthic macroinvertebrate communities, to a combination of several more complex measures of aquatic community health. All of these data measure deviation from conditions found in minimally impacted reference sites.

- Biosurvey data have been used primarily to establish designated uses and assess their attainment. Biocriteria and ambient biological sampling have been integrated into existing State programs (monitoring, permits, nonpoint source assessments, etc.).

- Valuable information can be obtained without performing intensive, complete surveys of ambient biological conditions. The costs of biosurveys make them competitive with toxicity testing and chemical-specific analyses.

WORKSHOP RECOMMENDATIONS

The Workshop's major recommendations are: (1) the concept of biocriteria and the information generated by ambient biological sampling should be integrated into the full spectrum of State and Federal surface water programs; and (2) the U.S. EPA should provide strong guidance to, and support for, State programs using these concepts. The development and implementation of biocriteria and ambient biological assessments is consistent with National statutory and regulatory mandates and clearly consistent with National policy. These conclusions are based upon a consensus of workshop participants and the practical experiences described by the States' representatives.

The Workshop was a forum for discussion and formulation of specific recommendations for the continued development and implementation of biocriteria. A summary of recommendations follows:

- The use of ambient biological sampling should be supported in State programs to identify aquatic life use impairment due to toxic and conventional parameters, from point and nonpoint sources. The States should use biosurvey data to evaluate aquatic life use attainability and attainment for WQA Sections 305(b), 304(l), 314, and 319 reporting requirements; spill evaluations; and "monitoring for environmental results."

- U.S. EPA should prepare a Technical Support Document for Development of Biocriteria and Use of Ambient Biological Sampling in surface water programs. This guidance would be consistent with requirements in the WQA Section 304(a)(8) and can be developed using information from existing State and U.S. EPA programs. States should be permitted flexibility to use methods and approaches suitable to their needs.

- In general, biosurvey data should be considered the optimum means to assess attainment of designated aquatic life uses. However, if chemical-specific, toxicity, and biosurvey methods yield apparently contradictory indications, none of the three types of evaluation should be assumed, a priori, to be superior to the others; rather the quality and appropriateness of the data used in each approach should determine the course of action. A protective strategy for decision making should be adopted in these cases until further studies are completed.

- The integration of biocriteria, and biosurvey and physical habitat assessment data into surface water programs should consider the relative strengths and appropriate uses of all assessment tools to maximize the effectiveness of monitoring programs. Integration into the effluent limits should be through the wasteload allocation and water quality standards process using a protective "weight of evidence" evaluation of information from all assessment tools. Guidance is needed on procedures to make these evaluations. Appropriate controls should not be withheld in the absence of any particular piece of information from biological or chemical assessments.

- Technology and information transfer among States, U.S. EPA and other Federal agencies, and academic institutions should be promoted. Simultaneous implementation of public education and participation programs for ambient biological studies will result in better understanding of the needs and goals of the regulatory agencies.

- The ecoregion concept and ecoregional reference sites should be used as:
  - benchmarks for evaluating use attainment and defining biological, chemical and physical integrity;
  - alternatives, or supplements, to upstream reference and downstream recovery sites;
  - tools to evaluate nonpoint source influences, as well as point source impairment; and
  - a framework for developing ecoregional biocriteria and water quality standards.

- A process should be developed for site-specific criteria (both chemical and biological) modification that incorporates biosurvey data.

- The Agency should support the development, evaluation, implementation, and use of numerical biocriteria by the States. These numerical criteria should be used to translate narrative criteria for protecting aquatic life uses into more quantifiable measures of attainment.